U.S. Department
of Transportation

Federal Aviation Administration

Advisory Circular

Subject: Change 5 to STANDARDS FOR SPECIFYING CONSTRUCTION OF AIRPORTS

Date: 4/2/93
Initiated by: AAS-200

AC No: 150/5370-10A
Change: 5

1. **PURPOSE.** Item P-401, Plant Mix Bituminous Pavements, has been changed to revise Table 2 and delete the requirement for voids filled with asphalt.

The change number and date of change is shown at the top of each page. The changed material is indicated by asterisks in the margins.

PAGE CONTROL CHART

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Leonard E. Mudd
LEONARD E. MUDD
Director, Office of Airport Safety and Standards

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The Engineer shall specify the number of days. A minimum of 10 days is recommended.

The Marshall Design Criteria applicable to a project shall be specified by the Engineer from the information shown below and inserted into Table 1. Asterisks denote insert points.

Test Property	Pavements Designed for Aircraft Gross Weights of 60,000 Lbs. or More or Tire Pressures of 100 Psi or More	Pavements Designed for Aircraft Gross Weight Less Than 60,000 Lbs. or Tire Pressure Less Than 100 Psi
Number of blows	75	50
Stability, pounds (newtons)	2150 (9555)	1350 (4450)
Flow, 0.01 in. (0.25 mm)	10–14	10–18
Air voids (percent)	2.8–4.2	2.8–4.2
Percent Voids in mineral aggregate (minimum)	See Table 2	See Table 2

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TABLE 1. MARSHALL DESIGN CRITERIA

TEST PROPERTY	*
Number of blows	*
Stability, pounds (newtons) minimum	*
Flow, 0.01 in. (0.25 mm)	*
Air voids (percent)	*
Percent voids in mineral aggregate, minimum	See Table 2

TABLE 2. MINIMUM PERCENT VOIDS IN MINERAL AGGREGATE

Maximum Particle Size (Table 3)		Minimum Voids in Mineral Aggregate
in.	mm	Percent
½	12.5	16
¾	19.0	15
1	25.0	14
1¼	31.25	13

The mineral aggregate shall be of such size that the percentage composition by weight, as determined by laboratory screens, will conform to the gradation or gradations specified in Table 3 when tested in accordance with ASTM Standard C 136 and C 117.

The gradations in Table 3 represent the limits which shall determine the suitability of aggregate for use from the sources of supply. The aggregate, as selected (and used in the JMF), shall have a gradation within the limits designated in Table 3 and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve, or vice versa, but shall be well graded from coarse to fine.

Deviations from the final approved mix design for bitumen content and gradation of aggregates shall be within the action limits for individual measurements as specified in paragraph 401-6.5a. The limits still will apply if they fall outside the master grading band in Table 3.

The maximum size aggregate used shall not be more than one-half of the thickness of the course being constructed.

TABLE 3. AGGREGATE - BITUMINOUS PAVEMENTS

Sieve Size	Percentage by Weight Passing Sieves
	*
1¼ in. (31.25 mm)	*
1 in. (25.0 mm)	*
¾ in. (19.0 mm)	*
½ in. (12.5 mm)	*
⅜ in. (9.5 mm)	*
No. 4 (4.75 mm)	*
No. 8 (2.36 mm)	*
No. 16 (1.18 mm)	*
No. 30 (0.60 mm)	*
No. 50 (0.30 mm)	*
No. 100 (0.15 mm)	*
No. 200 (0.075 mm)	*
Asphalt percent	
Stone or gravel	*
Slag	*

The aggregate gradations shown are based on aggregates of uniform specific gravity. The percentages passing the various sieves shall be corrected when aggregates of varying specific gravities are used, as indicated in the Asphalt Institute Manual Series No. 2 (MS-2), Appendix A.

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The aggregate gradation shall be specified by the Engineer from the gradations shown in this note. The gradation shall be inserted into Table 3. Asterisks denote insert points.

Where locally-available aggregates cannot be economically blended to meet the grading requirements of the gradations shown, the gradations may be modified to fit the characteristics of such local aggregates with approval of the FAA. The modified gradation must produce a paving mixture that satisfies the mix design requirements.

For pavements designed to accommodate aircraft gross weights of 12,500 pounds (5 662 kg) or less, this section may be modified to permit the use of state highway department specifications for high-quality, hot-mix bituminous pavements that have a satisfactory performance record under equivalent loadings and exposure. When a density requirement is not specified by a state specification, the Engineer should specify an average of 98 percent of laboratory density based on four random tests per day.

When a state specification that specifies a density is used, paragraphs 401-5.1, 5.2, 5.3, and 8.1a should be deleted. When a state specification that does not specify a density is used, paragraph 401-5.1 should be modified to require only mat density tests and paragraphs 401-5.2. 5.3, and 8.1a should be deleted.

AGGREGATE—BITUMINOUS PAVEMENTS

Sieve Size	Percentage by Weight Passing Sieves			
	1¼"max	1" max	¾" max	½" max
1¼ in. (30.0 mm)	100	—	—	—
1 in. (24.0 mm)	86–98	100	—	—
¾ in. (19.0 mm)	68–93	76–98	100	—
½ in. (12.5 mm)	57–81	66–86	79–99	100
⅜ in. (9.5 mm)	49–69	57–77	68–88	79–99
No. 4 (4.75 mm)	34–54	40–60	48–68	58–78
No. 8 (2.36 mm)	22–42	26–46	33–53	39–59
No. 16 (1.18 mm)	13–33	17–37	20–40	26–46
No. 30 (0.600 mm)	8–24	11–27	14–30	19–35
No. 50 (0.300 mm)	6–18	7–19	9–21	12–24
No. 100 (0.150 mm)	4–12	6–16	6–16	7–17
No. 200 (0.075 mm)	3–6	3–6	3–6	3–6
Asphalt percent:				
Stone or gravel	4.5–7.0	4.5–7.0	5.0–7.5	5.5–8.0
Slag	5.0–7.5	5.0–7.5	6.5–9.5	7.0–10.5

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401-3.3 RECYCLED ASPHALT CONCRETE. Recycled asphalt concrete shall consist of reclaimed asphalt pavement (RAP), coarse aggregate, fine aggregate, mineral filler, asphalt cement, and recycling agent, if necessary. Reclaimed asphalt pavement may be used for all courses.

The RAP shall be of a consistent gradation and asphalt content. The Contractor may obtain the RAP from the job site or an existing source.

All new aggregates used in the recycled mix shall meet the requirements of paragraph 401-2.1. New bituminous material shall meet the requirements of paragraph 401-2.3. Recycling agents shall meet the requirements of ASTM D 4552.

The recycled asphalt concrete mix shall be designed using procedures contained in the Asphalt Institute's Manual Series Number 20 (MS-20), Asphalt Hot-Mix Recycling, in conjunction with MS-2 (MS-2). The job mix shall meet the requirements of paragraph 401-3.2. In addition to the requirements of paragraph 401-3.2, the job mix formula shall indicate the percent of reclaimed asphalt pavement, the percent and viscosity grade of new asphalt, the percent and grade of hot-mix recycling agent (if used), and the properties (including viscosity and penetration) of the asphalt blend.

The Contractor shall submit documentation to the Engineer, indicating that the mixing equipment proposed for use is adequate to mix the percent of RAP shown in the job mix formula and meet all local and national environmental regulations.

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Delete this paragraph if recycled asphalt pavement is not to be allowed and include a sentence that RAP will not be permitted to be used.

Recycling agents should be used when the desired viscosity of the asphalt blend cannot be obtained using only a soft asphalt.

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401-3.4 TEST SECTION. Prior to full production, the Contractor shall prepare and place a quantity of bituminous mixture according to the job mix formula. The amount of mixture should be sufficient to construct a test section [ ] long and [ ] wide placed in two lanes, with a longitudinal cold joint, and shall be of the same depth specified for the construction of the course which it represents. The underlying grade or pavement structure upon which the test section is to be constructed shall be the same as the remainder of the course represented by the test section. The equipment used in construction of the test section shall be the same type and weight to be used on the remainder of the course represented by the test section.

Three random samples shall be taken at the plant and tested for stability, flow, and air voids in accordance with paragraph 401-5.1a(2). Three randomly selected cores shall be taken from the finished pavement mat, and three from the longitudinal joint, and tested in accordance with paragraph 401-5.1b(4). Random sampling shall be in accordance with procedures contained in ASTM D 3665.

Stability, flow, and air voids shall be evaluated in accordance with paragraph 401-5.2b. Mat density shall be evaluated in accordance with paragraph 401-5.2c. Joint density shall be evaluated in accordance with paragraph 401-5.2d. The test section shall be considered acceptable if the percentage of material within limits (PWL) is 90 or more.

Two random samples of mixture shall be taken at the plant and tested for aggregate gradation and asphalt content in accordance with paragraphs 401-6.3a and 3b and evaluated in accordance with paragraphs 401-6.5a and 5b. The test section shall be considered acceptable if the gradation and asphalt content are within the limits specified in paragraphs 401-6.5a and 5b.

Voids in the mineral aggregate (VMA), for each plant sample, shall be computed in accordance with procedures contained in Chapter III, MARSHALL METHOD OF MIX DESIGN, of the Asphalt Institute's Manual Series No. 2 (MS-2), Mix Design Methods for Asphalt Concrete.

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The test section shall be considered acceptable if the voids in the mineral aggregate is within the limits of Table 1.

If the test section should prove to be unsatisfactory, the necessary adjustments to the job mix formula, plant operation, placing procedures, and/or rolling procedures shall be made. A second test section shall then be placed. If the second test section also does not meet specification requirements, both sections shall be removed at the Contractor's expense. Additional test sections, as required, shall be constructed and evaluated for conformance to the specifications. Any additional sections that do not conform to specification requirements shall be removed at the Contractor's expense. Full production shall not begin until a satisfactory section has been constructed and accepted by the Engineer. The initial test section and any subsequent section that meets specification requirements shall be paid for in accordance with paragraph 401-8.1.

Job mix control testing shall be performed by the Contractor at the start of plant production and in conjunction with the calibration of the plant for the job mix formula. It should be recognized that the aggregates produced by the plant may not satisfy the gradation requirements or produce a mix that exactly meets the JMF. In those instances, it will be necessary to reevaluate and redesign the mix using plant-produced aggregates. Specimens should be prepared and the optimum bitumen content determined in the same manner as for the original design tests.

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The test section should be a minimum of 300 feet (90 m) long and 20 to 30 feet (6 to 9 m) wide. The test section affords the Contractor and the Engineer an opportunity to determine the quality of the mixture in place, as well as performance of the plant and laydown equipment.

Until the plant is producing the desired mix consistency, frequent testing may be necessary.

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401-3.5 TESTING LABORATORY. The laboratory used to develop the job mix formula shall meet the requirements of ASTM D 3666. A certification signed by the manager of the laboratory stating that it meets these requirements shall be submitted to the Engineer prior to the start of construction. The certification shall contain as a minimum:

- **a.** Qualifications of personnel; laboratory manager, supervising technician, and testing technicians.
- **b.** A listing of equipment to be used in developing the job mix.
- **c.** A copy of the laboratory's quality control system.
- **d.** Evidence of participation in the AASHTO Materials Reference Laboratory (AMRL) program

CONSTRUCTION METHODS

401-4.1 WEATHER LIMITATIONS. The bituminous mixture shall not be placed upon a wet surface or when the surface temperature of the underlying course is less than specified in Table 4. The temperature requirements may be waived by the Engineer, if requested; however, all other requirements including compaction shall be met.

TABLE 4. BASE TEMPERATURE LIMITATIONS

Mat Thickness	Deg. F	Deg. C
3 in. (7.5 cm) or greater	40	4
Greater than 1 in. (2.5 cm) but less than 3 in. (7.5 cm)	45	7
1 in. (2.5 cm) or less	50	10

401–4.2 BITUMINOUS MIXING PLANT. Plants used for the preparation of bituminous mixtures shall conform to the requirements of ASTM D 995 with the following changes:

a. Requirements for All Plants.

(1) Truck Scales. The bituminous mixture shall be weighed on approved scales furnished by the Contractor, or on certified public scales at the Contractor's expense. Scales shall be inspected and sealed as often as the Engineer deems necessary to assure their accuracy. Scales shall conform to the requirements of the General Provisions, Section 90–01.

(2) Testing Facilities. The Contractor shall provide laboratory facilities at the plant for the use of the Engineer's acceptance testing and the Contractor's quality control testing, in accordance with paragraph 401–6.2d.

(3) Inspection of Plant. The Engineer, or Engineer's authorized representative, shall have access, at all times, to all areas of the plant for checking adequacy of equipment; inspecting operation of the plant: verifying weights, proportions, and material properties; and checking the temperatures maintained in the preparation of the mixtures.

(4) Storage Bins and Surge Bins. Paragraph 3.9 of ASTM D 995 is deleted. Instead, the following applies. Use of surge bins or storage bins for temporary storage of hot bituminous mixtures will be permitted as follows:

(a) The bituminous mixture may be stored in surge bins for period of time not to exceed 3 hours.

(b) The bituminous mixture may be stored in insulated storage bins for a period of time not to exceed 24 hours.

The bins shall be such that mix drawn from them meets the same requirements as mix loaded directly into trucks.

If the Engineer determines that there is an excessive amount of heat loss, segregation or oxidation of the mixture due to temporary storage, no overnight storage will be allowed.

401–4.3 HAULING EQUIPMENT. Trucks used for hauling bituminous mixtures shall have tight, clean, and smooth metal beds. To prevent the mixture from adhering to them, the truck beds shall be lightly coated with a minimum amount of paraffin oil, lime solution, or other approved material. Each truck shall have a suitable cover to protect the mixture from adverse weather. When necessary, to ensure that the mixture will be delivered to the site at the specified temperature, truck beds shall be insulated or heated and covers shall be securely fastened.

401–4.4 BITUMINOUS PAVERS. Bituminous pavers shall be self–propelled, with an activated screed, heated as necessary, and shall be capable spreading and finishing courses of bituminous plant mix material which will meet the specified thickness, smoothness, and grade. The paver shall have sufficient power to propel itself and the hauling equipment without adversely affecting the finished surface.

The paver shall have a receiving hopper of sufficient capacity to permit a uniform spreading operation. The hopper shall be equipped with a distribution system to place the mixture uniformly in front of the screed without segregation. The screed shall effectively produce a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture.

If an automatic grade control device is used, the paver shall be equipped with a control system capable of automatically maintaining the specified screed elevation. The control system shall be automatically actuated from either a reference line and/or through a system of mechanical sensors or sensor–directed mechanisms or devices